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Design and Construction of the Oil Palm Fruit Sorting Device Based on Color with PC Display

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Abstract. This research discusses the design and construction of an oil palm fruit sorting tool and a counter for the number of oil palm fruits that work automatically using the working principle of a color sensor. This tool can work automatically because it is controlled by an ATmega328 microcontroller. Overall this system consists of designing a color sensor, motor controller, conveyor, and power supply. Item detection consists of 328 microcontroller technology, color sensor, proximity sensor, LCD, IOT, and PC display. The testing stages of this tool include testing the sensor circuit, testing the servo motor circuit, and testing the automatic oil palm fruit sorting and counting tool. When the oil palm fruit is detected, the color sensor will take data. The captured data will be sent to the microcontroller and displayed to the LCD, IOT and PC. There are additional devices in the form of undercooked, ripe and past ripe separation bars by utilizing a DC servo motor.

Keyword: ATmega328, conveyor, IOT, LCD, DC motor, servo motor, color sensor.

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1 Introduction

Companies always try to replace jobs that have been done by humans to be replaced with machine in the context of efficiency and increasing the quality of their production. In other words, many companies automate their production [1-3].

The loss of palm oil in the fresh fruit bunch (FFB) sterilization process is influenced by the content of crude palm fruit, the length of time for boiling and the steam pressure [4-5]. If the crude palm fruit content is high, then longer sterilization and higher steam pressure are required [6]. The loss of palm oil in the fresh fruit bunch (FFB) sterilization process is influenced by the content of crude palm fruit, the length of time for boiling and the steam pressure. If the crude palm fruit content is high, then longer sterilization and higher steam pressure are required. On the other hand, if the FFB is overripe, it will require a shorter sterilization time and lower steam pressure to reduce palm oil losses during the sterilization process. At this time the calculation of the content of crude palm fruit entering the factory is still carried out based on visual

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observations, so that the loss of palm oil in the sterilization process is still high, which is more than the standard of 0.3% [7].

2 Methods

The structural model of the device is given in Figure 1 while the flowchart is shown in Figure 2.

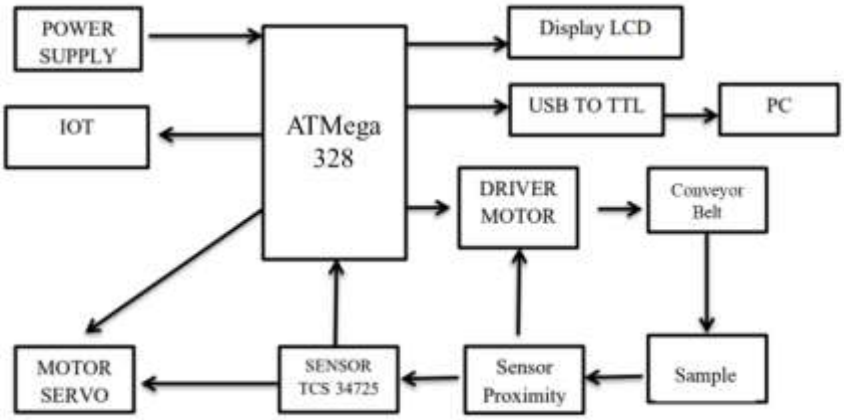

Figure 1. Block Diagram of the System

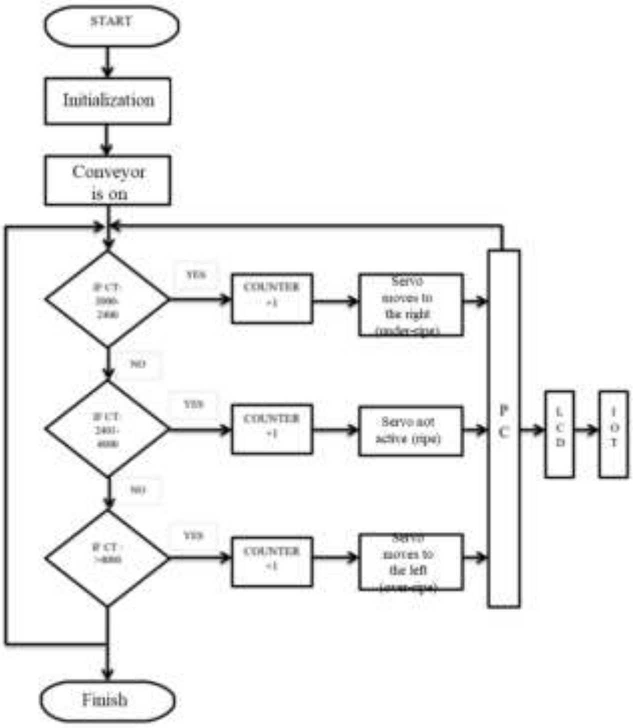

Figure 2. Flowchart of the System

3 Result and Discussion

3.1 TCS34725 Color Sensor Circuit Testing

Detecting the color of the oil palm fruit was done by color sensor, while the fruit has been varied in the fraction of raw, ripe, and past ripe which then detects the level of maturity carried out by the color sensor. Table 1 shows the results.

Table 1. RGB Value on Oil palm Fruit

No	Sensor 1				Sensor 2				Color Temperature (K)
	R	G	B	CT	R	G	B	CT	
1	173	293	273	3952	243	230	224	7597	5774
2	726	618	382	4155	354	319	292	3113	3634
3	799	410	311	2519	568	350	297	2211	2364

3.2 Proximity Sensor Testing

The input and output functions of sensor 1 and sensor 2 testing to work properly shown in Table 2. Furthermore, the test carried out is by providing program instructions to read each input from the input component.

Table 2. Proximity Sensor Output Voltage Testing

Proximity Sensor	**On** (V)	**Off** (V)
Proximity 1	5	0
Proximity 2	5	0

3.3 Power Supply Circuits Testing

In the test, the input voltage from PLN is 220 Volt AC then it goes to the transformer to be changed to 12 Volt AC, then it is directed to the Diode of 12 Volt DC. After the measurement, the output voltage is 5 volts. It can be ascertained whether there is an error with the circuit or not. If measured, the result of an impure voltage output of 5 volts. This result is due to several factors, including the quality of each component used, the value is impure. In addition, the voltage on the grid is unstable. The following is the power supply output voltage data shown in Table 3.

Table 3. Power Supply Testing of ATMega 328

Input	Output
12 Volt	5 Volt

3.4 Whole Circuit Testing

Testing the whole system is carried out to find out whether the entire circuit can run well; it is given in Table 4. Initially the proximity sensor will detect the object, then the color sensor will detect the RGB value that has varied its maturity. Furthermore, the results of the reading of this tool will be displayed on the LCD, PC and IOT. The RGB data on the TCS34725 sensor has a feature that provides a gain of 60 times to be able to distinguish colors specifically and in detail [8-10]. The following is the test data for the palm loose fruit count and separator based on the maturity fraction shown with the following conditions:

a. Sensor 1 is placed on the right side of the Conveyor Belt

b. Sensor 2 is placed on the left side of the Conveyor Belt

c. The Color Temperature value is obtained from the average value of CT sensor 1 and CT sensor 2

Table 4. The Data of The Whole Testing

No	Sensor 1				Sensor 2				Colour Temperature (K)	Maturity level
	R	G	B	CT	R	G	B	CT		
1	173	293	273	3952	243	230	224	7597	5774	under ripe
2	726	618	382	4155	354	319	292	3113	3634	ripe
3	799	410	311	2519	568	350	297	2211	2364	Over ripe
4	1691	898	567	2304	1655	728	508	2283	2298	Over ripe
5	299	299	275	4054	264	239	230	4591	4322	under ripe
6	1131	1148	1092	3767	395	371	357	5021	5021	under ripe
7	396	252	209	3287	875	552	521	2808	3042	ripe
8	868	433	301	2353	696	406	332	2188	2270	Over ripe
9	745	403	665	3684	1038	767	665	2302	2993	ripe
10	1057	1073	1013	4330	260	251	236	4552	4580	under ripe
11	2597	2767	1661	3153	269	210	197	3808	3480	ripe
12	779	749	762	3931	268	246	226	5102	4516	under ripe
13	2428	1020	688	2395	957	434	382	2168	2281	Over ripe
14	460	308	286	2983	3446	1669	1483	2790	2967	ripe
15	1671	1562	1201	3937	321	283	255	3966	3951	ripe
16	1054	1067	1006	3073	373	331	288	4980	4426	under ripe
17	2428	1020	688	2395	957	434	382	2168	2281	Over ripe
18	942	432	312	2257	1669	708	542	2190	2223	Over ripe
19	1523	876	535	2548	1121	544	449	2381	2464	ripe
20	1327	631	463	2389	560	463	292	2318	2353	Over ripe

In this test, twenty experiments were carried out to determine the accuracy of the calculations. To determine the accuracy of the sensor in detection, testing was carried out by providing different samples. Twenty tests were carried out for fruit with different colors.

4 Conclusion

From the results of designing tools to testing and discussion of the system, the authors can draw conclusions that designed a tool that can count and sort oil palm fruit based on the level of fruit color maturity has been successfully designed using ATMega328 microcontroller. This tool works to detect the color of the oil palm fruit and count the number of fruit samples by utilizing a color sensor and a servo motor that will sort the fruit by size. The working principle of the oil palm fruit sorting tool uses a microcontroller-based color, namely when the fruit runs on the conveyor belt and passes the proximity sensor beam, the conveyor stops then sensor 1 and sensor 2 identify it, if the fruit is categorized as under ripe by the color sensor, the microcontroller gives instructions for moving servo signposts. to the right, if the fruit is categorized as ripe by the color sensor, the microcontroller gives instructions to the servo signpost off and if the fruit is categorized as ripe by the color sensor, the microcontroller gives instructions for the servo signpost to move to the left.

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